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Life History Data on Alewife and Blueback Herring, Mactaquac Dam, 1982-88

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by

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ABSTRACT

Jessop, B.M. and W.E. Anderson. 1991. Life-history data on alewife and blueback herring, Mactaquac Dam, 1982-88. Can. Data Rep. Fish. Aquat. Sci. No. 829: 42p.

Life-history data were collected annually between 1982 and 1988 for the alewife and blueback herring migrating to the Mactaquac Dam, Saint John River, New Brunswick. This report tabulates the data, in various combinations, according to species, sex, length, weight, age, maturity and spawning history.

Key words: Life-history, alewife, blueback herring, gaspereau, anadromous, Mactaquac Dam, Saint John River, hydroelectric development.

RÉSUMÉ

Jessop, B.M. and W.E. Anderson. 1991. Life-history data on alewife and blueback herring, Mactaquac Dam, (1982-88.) Can. Data Rep. Fish. Aquat. Sci. No. 829: 42p.

Entre 1982 et 1988, on a recueilli chaque année des données relatives au cycle biologique du gaspareau et de l'alose d'été remontant la rivière Saint-Jean jusqu'au barrage de Mactaquac (Nouveau-Brunswick). Ce rapport présente les données sous forme de tableaux, en les combinant de diverses façons, selon l'espèce, le sexe, la longueur, le poids, l'âge la maturité et l'historique du frai.

INTRODUCTION

Creation of a large headpond on the Saint John River, New Brunswick, by the completion of the Mactaquac Dam in 1967 led to the rapid development of major stocks of alewives *(Alosa pseudoharengus)* and blueback herring *(A. aestivalis)*, collectively and colloquially termed gaspereau. In 1973, a study was begun of the life history and population dynamics of the gaspereau of the Saint John River, with the objectives of: (1) establishing whether alewife and blueback herring populations are homogeneous within the river or form distinct local populations, (2) evaluating the influence of the commercial fishery and hydroelectric development on the populations, and (3) providing a data base for the establishment and evaluation of management programs.

This report presents tabulations of the life-history data collected annually between 1982 and 1988. The data for 1973 and 1974 are given in Jessop (1977 a, b), and for 1975-81 in Jessop et. al. (1982).

Mactaquac Dam is the furthest downstream (148 km from the river mouth) of the three main-stem hydroelectric dams constructed on the Saint John River (Fig. 1). Its construction created a headpond of approximately 83.5 km², which extends about 104 km upriver. During low-flow periods, the dam is operated as a peak-load plant, and during high-flow periods (spring runoff and rainfall floods), as a base-load plant. Fish passage facilities include both a mechanical elevator and tank trucks, which in combination relay fish to release points upstream of the dam.

METHODS

During the run, random samples of 100 were collected twice weekly from the fish-lift. Each fish was measured for fork length to the nearest millimetre, weighed to the nearest gram and identified as to sex, state of maturity and species. Scale samples were collected for aging. Maturity was classified according to Nikolsky (1963). Species were identified according to color of the peritoneum (Bigelow and Schroeder 1953).

Whenever possible, scales were taken from the left side of each fish, just above the lateral line and behind the posterior edge of the dorsal fin. Eight to ten scales were placed on transparent plastic slides (Power 1964), and each sample was independently aged twice without reference to associated length or weight data. If readings differed, a third reading was made and an age assigned on the basis of majority agreement. A few fish were unageable, due either to a lack of scales, scales with regenerate centers or aging disagreements.

Age was determined for adult fish by counting the number of annuli and spawning marks and adding a year for the scale edge (Cating 1953; Marcy 1969). Fish under age four frequently exhibited "plus" growth, and judgement based upon capture date was used in deciding whether or not to add a year for the scale edge. Scale analysis included counting the number of transverse grooves in order to establish a criterion for locating annuli that were difficult to interpret.

The age at first spawning of mature, virgin (no previous spawns evident on scales) gaspereau was recorded as the age at capture during the spawning run. A small proportion of older, mature fish show checks, sometimes resembling spawning checks, between annuli laid previously at Age 2 and, occasionally, at Age 3. Such checks at Age 2 are presumed not to be spawning marks but evidence of freshwater entry, because virtually all (>99%) Age-2 fish sampled have been sexually immature and small numbers of immature fish (mostly alewives [>85%] and mostly Age 2, but with a few [<5%] Age 3) are frequently found in the lake system of the lower Saint John River, e.g., Washademoak and Grand lakes, during the latter part of the spawning run (mid to late June). Non-annular checks at Age 3 were considered as spawning marks if well defined erosion and little plus growth to the annulus were evident; otherwise they were considered freshwater checks. The effect on spawning history patterns of any errors in judgement should be minimal, given the small numbers of fish involved.

RESULTS AND DISCUSSION

The data have been tabulated in various combinations according to species, sex, length, weight, age, maturity and spawning history (Tables 1-17). Between tables, totals may not always agree due to incomplete data; i.e., unageable scales. Variance has been calculated using degrees of freedom (n-1) rather than n. The relationship between sample standard deviation (s) and the estimated population standard deviation *(s)*

$$is\ s = s\sqrt{\frac{n-1}{n}}\ .$$

The calculation of standard deviation as the square root of s², as done here, consistently underestimates σ (parametric population standard deviation), particulary for sample sizes <30. The bias can be corrected by applying the correction factor given in Sokal and Rohlf (1981,p.53). No analysis has been presented of the data contained in this report; the analysis will be made in a subsequent technical report.

Conversion between fork and total lengths for alewives in the fork length interval from 130 mm to 320 mm and for blueback herring in the interval from 180 to 270 mm, respectively, can be obtained from Jessop et. al. (1982).

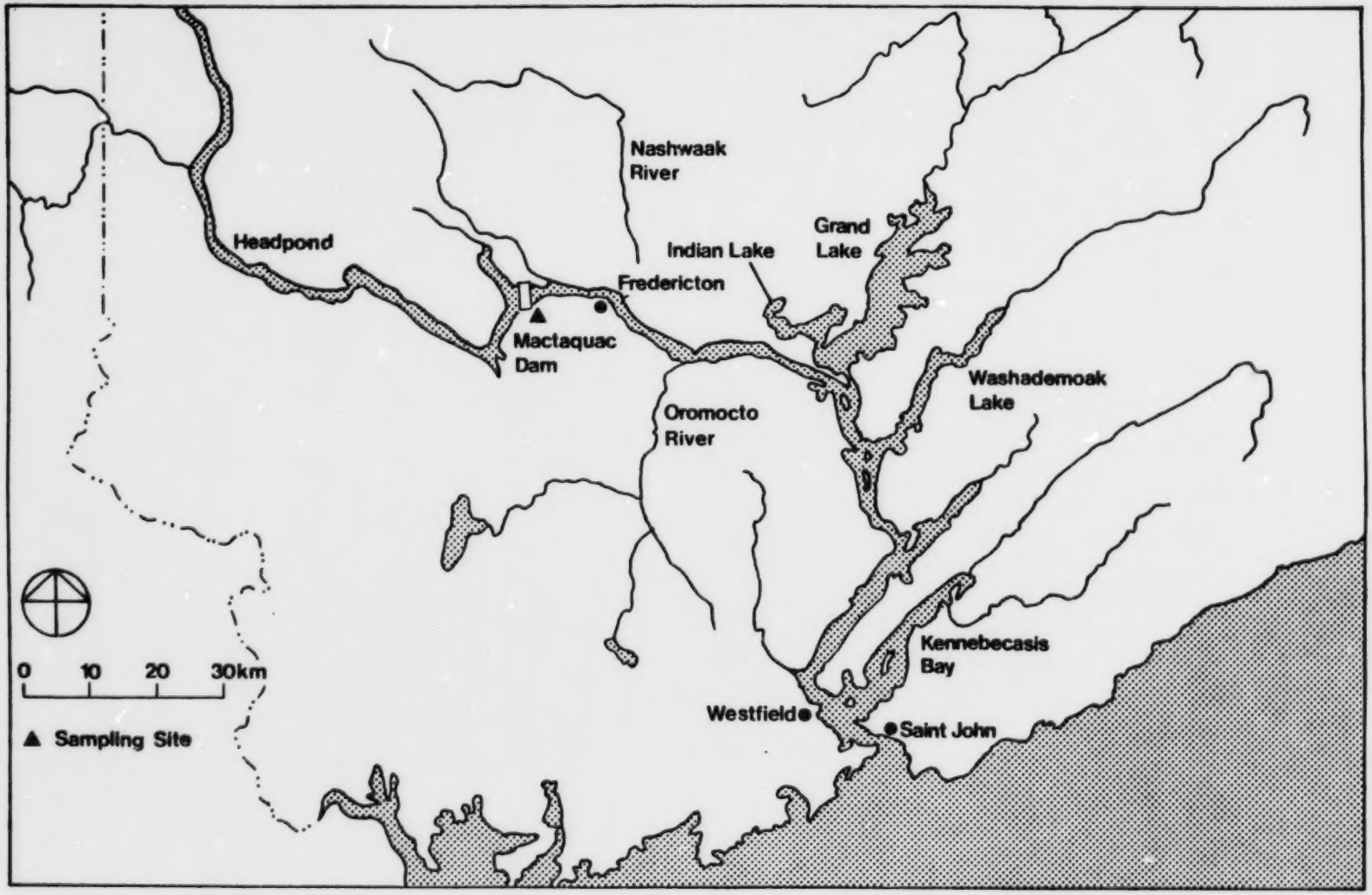

Figure 1. Lower Saint John River system, showing location of Mactaquac Dam.

Table 1. Mean fork length (mm) of alewife by sex, age and year, Mactaquac Dam, 1982 - 1988.

		Male				Female			
Year	Age	N	Mean	Range	SD	N	Mean	Range	SD
1982	3	1	241.0	241-241	-	0	-	-	-
	4	64	253.8	232-275	10.19	29	260.4	245-277	7.03
	5	163	268.4	237-287	9.35	143	276.8	259-302	9.10
	6	49	277.8	252-298	10.02	55	288.3	272-307	8.92
	7	14	289.5	274-304	8.30	29	301.5	280-348	12.34
	8	18	292.7	274-307	10.81	43	305.7	290-334	9.06
	9	8	299.4	281-309	9.55	11	303.6	290-314	7.06
	10	1	280.0	280-280	-	4	308.8	282-323	18.68
	11	0	-	-	-	1	287.0	287-287	-
1983	3	3	233.7	228-241	6.66	1	217.0	217-217	-
	4	61	250.2	216-274	10.03	44	259.4	220-315	17.12
	5	166	269.1	220-302	13.21	140	278.2	242-320	11.81
	6	114	278.9	253-308	9.73	132	290.9	263-320	11.38
	7	24	285.1	264-311	10.04	27	298.4	282-318	9.09
	8	6	290.2	272-310	14.82	13	303.7	284-331	13.66
	9	2	268.0	268-268	0.00	7	302.0	281-317	13.64
	10	0	-	-	-	1	276.0	276-276	-
	11	0	-	-	-	0	-	-	-
	12	1	293.0	293-293	-	0	-	-	-
1984	3	1	223.0	223-223	-	1	210.0	210-210	-
	4	100	245.7	223-270	8.87	56	250.0	219-270	10.62
	5	152	260.9	222-290	10.54	183	267.8	240-300	11.73
	6	60	276.7	255-294	8.58	78	283.4	257-302	9.39
	7	26	285.7	272-313	9.46	48	296.9	278-315	9.01
	8	6	289.2	270-304	11.23	16	303.7	294-317	6.54
	9	2	303.0	302-304	1.41	1	315.0	315-315	-
	10	0	-	-	-	3	310.0	300-317	8.89
	11	0	-	-	-	1	327.0	327-327	-
1985	3	20	225.7	212-237	7.33	3	226.3	224-230	3.21
	4	82	244.1	220-265	11.76	33	248.9	220-268	11.06
	5	159	267.8	240-302	9.01	116	274.7	250-304	9.82
	6	51	275.0	248-295	10.18	69	286.4	264-306	10.37
	7	25	290.5	275-308	8.97	28	298.9	265-320	11.13
	8	5	294.2	288-300	5.76	15	310.6	295-338	10.88
	9	0	-	-	-	5	314.8	310-322	6.14
	10	1	319.0	319-319	-	1	306.0	306-306	-
1986	3	1	221.0	221-221	-	1	233.0	233-233	-
	4	322	249.9	215-275	9.40	247	257.0	223-280	8.54
	5	40	267.1	250-287	8.55	31	273.6	250-293	9.60
	6	21	277.8	268-293	6.21	18	292.1	278-302	6.41
	7	2	294.0	293-295	1.41	1	310.0	310-310	-
	8	0	-	-	-	1	300.0	300-300	-
	9	1	307.0	307-307	-	0	-	-	-
1987	3	2	218.5	218-219	0.71	1	224.0	224-224	-
	4	136	245.1	229-260	7.04	125	251.6	234-275	8.79
	5	217	263.4	239-286	7.78	181	270.8	247-295	8.76
	6	18	272.6	255-284	7.00	19	287.1	271-311	8.24
	7	6	283.7	261-308	15.36	3	302.7	292-311	11.21
1988	3	1	227.0	227-227	-	1	219.0	219-219	-
	4	68	238.9	217-253	7.42	50	243.6	225-255	7.33
	5	145	258.0	241-277	6.89	129	263.9	248-283	7.51
	6	110	270.1	248-326	8.99	117	279.3	253-300	7.93
	7	8	282.8	270-305	10.91	16	287.6	270-298	8.50

Table 2. Mean fork length (mm) of blueback herring by sex, age and year, Mactaquac Dam, 1982 - 1988.

		Male				Female			
Year	Age	N	Mean	Range	SD	N	Mean	Range	SD
1982	3	143	202.9	183-235	9.29	36	210.1	187-233	11.13
	4	97	232.4	202-261	12.25	93	238.2	207-268	12.05
	5	66	246.7	222-281	11.38	93	255.9	226-282	10.46
	6	40	251.6	230-267	8.40	68	263.7	237-279	7.41
	7	19	257.3	245-268	6.43	25	269.8	248-287	10.90
	8	28	263.6	246-292	10.76	26	276.8	262-299	9.31
	9	26	268.6	256-283	7.24	30	279.0	252-307	11.50
	10	13	266.5	253-284	8.79	9	287.0	278-299	7.30
	11	2	261.0	260-262	1.41	4	289.3	282-295	5.91
	12	1	265.0	265-265	-	1	302.0	302-302	-
1983	3	136	201.0	178-237	10.74	49	211.1	185-247	13.50
	4	120	220.4	190-255	12.88	107	231.8	191-265	10.76
	5	60	237.2	219-273	11.99	79	245.9	221-297	13.32
	6	13	251.5	225-278	14.81	25	260.9	240-292	13.41
	7	12	256.5	234-270	9.68	9	268.7	254-280	8.12
	8	6	262.5	259-271	4.51	8	273.8	256-281	7.91
	9	2	268.5	253-284	21.92	6	281.2	265-312	16.85
	10	7	266.1	254-277	6.96	0	-	-	-
	11	0	-	-	-	3	289.0	272-306	17.00
	12	1	288.0	288-288	-	1	293.0	293-293	-
1984	3	88	196.8	175-220	8.99	40	201.2	183-220	9.53
	4	196	219.1	195-251	7.26	208	226.8	208-255	7.74
	5	46	231.2	207-257	10.21	61	237.9	217-262	8.94
	6	13	243.6	231-271	12.18	13	252.9	240-280	12.77
	7	6	249.5	235-258	8.69	5	263.4	256-269	5.32
	8	0	-	-	-	5	270.0	242-302	22.44
	9	2	266.5	265-268	2.12	2	285.0	282-288	4.24
	10	1	260.0	260-260	-	1	280.0	280-280	-
	11	0	-	-	-	0	-	-	-
	12	0	-	-	-	1	302.0	302-302	-
1985	3	330	191.8	166-219	8.50	170	198.8	180-228	7.55
	4	130	217.2	186-255	10.89	177	226.7	195-250	9.77
	5	50	229.7	210-245	7.89	62	237.1	214-264	10.87
	6	11	238.7	216-252	10.17	11	249.8	235-270	9.61
	7	2	261.5	252-271	13.44	0	-	-	-
	8	0	-	-	-	2	280.0	280-280	0.00
1986	3	85	193.0	171-220	10.09	15	199.0	184-212	8.73
	4	138	213.2	190-247	9.82	223	221.3	198-246	8.60
	5	15	232.6	213-273	13.96	13	241.8	220-271	13.34
	6	4	246.3	240-253	5.32	2	247.5	235-260	17.68
1987	3	41	192.6	177-222	9.26	16	196.6	184-213	8.57
	4	249	210.4	188-237	9.56	278	215.6	197-242	8.44
	5	57	222.0	198-246	10.24	107	236.5	213-258	8.83
	6	3	243.0	235-257	12.17	5	251.0	242-262	9.67
	7	2	251.5	247-256	6.36	1	255.0	255-255	-
1988	3	121	187.8	173-202	6.22	20	193.5	185-208	6.30
	4	242	207.8	190-231	8.14	210	215.4	194-241	9.47
	5	150	217.9	197-240	8.92	171	230.2	198-260	9.15
	6	16	232.9	210-261	14.71	29	242.3	225-256	8.82

Table 3. Spawning history of alewife, by sex and year, Mactaquac Dam, 1982 - 1988.

No. previous spawnings	1982			1983			1984			1985			1986			1987			1988		
	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age
Male																					
0	163	51.3	4.7	117	31.0	4.6	151	43.5	4.6	107	31.2	4.3	196	50.7	4.1	167	44.1	4.3	106	31.9	4.5
1	67	21.1	5.0	121	32.1	5.2	98	28.2	4.9	134	39.1	4.8	158	40.8	4.1	119	31.4	4.9	107	32.2	5.1
2	43	13.5	5.7	86	22.8	5.7	62	17.9	5.7	72	21.0	5.5	26	6.7	5.6	86	22.7	5.2	86	25.9	5.8
3	26	8.2	6.9	40	10.6	6.3	22	6.3	6.5	22	6.4	6.9	6	1.6	6.3	7	1.9	6.6	33	9.9	6.1
4	9	2.8	8.0	7	1.9	7.4	10	2.9	7.5	6	1.8	7.2	1	0.3	9.0	0	-	-	0	-	-
5	9	2.8	8.7	4	1.1	8.3	4	1.2	8.3	1	0.3	8.0	0	-	-	0	-	-	0	-	-
6	0	-	-	1	0.3	9.0	0	-	-	1	0.3	10.0	0	-	-	0	-	-	0	-	-
7	1	0.3	10.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
8	0	-	-	1	0.3	12.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Totals	318			377			347			343			387			379			332		
Repeat spawners		48.7			69.0			56.5			68.8			49.3			55.9			68.1	
Female																					
0	122	38.7	4.9	98	26.9	4.7	148	38.2	4.8	71	26.1	4.8	163	54.5	4.0	162	49.2	4.3	119	37.5	4.6
1	69	21.9	5.4	117	32.1	5.3	108	27.9	5.2	102	37.5	5.2	105	35.1	4.2	101	30.7	5.0	84	26.5	5.3
2	46	14.6	5.8	81	22.2	5.9	76	19.6	5.8	56	20.6	5.8	25	8.4	5.5	60	18.2	5.2	87	27.4	5.9
3	47	14.9	7.6	49	13.4	6.3	22	5.7	6.5	25	9.2	7.0	5	1.7	6.2	6	1.8	6.0	24	7.6	6.4
4	18	5.7	8.2	8	2.2	8.0	25	6.5	7.4	11	4.0	7.6	1	0.3	8.0	0	-	-	3	1.0	7.0
5	7	2.2	8.6	9	2.5	8.3	4	1.0	8.5	6	2.2	8.7	0	-	-	0	-	-	0	-	-
6	2	0.6	9.0	2	0.5	9.0	1	0.3	9.0	0	-	-	0	-	-	0	-	-	0	-	-
7	3	1.0	10.0	1	0.3	10.0	2	0.5	10.0	1	0.4	10.0	0	-	-	0	-	-	0	-	-
8	1	0.3	11.0	0	-	-	1	0.3	11.0	0	-	-	0	-	-	0	-	-	0	-	-
Totals	315			365			387			272			299			329			317		
Repeat spawners		61.2			73.2			61.8			73.9			45.5			50.8			62.5	
Sexes combined																					
Repeat spawners		55.0			71.0			59.3			71.1			47.7			53.5			65.3	

Table 4. Spawning history of blueback herring, by sex and year, Mactaquac Dam, 1982 - 1988.

No. previous spawnings	1982			1983			1984			1985			1986			1987			1988		
	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age	N	%	Mean age
Male																					
0	194	44.6	3.3	200	56.0	3.4	180	51.1	3.5	374	71.2	3.1	155	64.1	3.5	164	46.6	3.8	260	49.2	3.6
1	88	20.2	4.4	101	28.3	4.3	128	36.4	4.2	124	23.6	4.3	74	30.6	4.1	145	41.2	4.1	159	30.1	4.3
2	53	12.2	5.5	23	6.4	5.3	28	8.0	5.2	21	4.0	5.1	11	4.6	5.2	41	11.7	5.1	101	19.1	5.1
3	18	4.1	6.4	11	3.1	6.6	9	2.6	6.2	6	1.1	6.3	2	0.8	6.0	1	0.3	7.0	9	1.7	6.0
4	19	4.4	7.4	8	2.2	7.3	5	1.4	7.4	0	-	-	0	-	-	1	0.3	7.0	0	-	-
5	27	6.2	8.2	4	1.1	8.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
6	22	5.1	9.1	5	1.4	9.6	2	0.6	9.5	0	-	-	0	-	-	0	-	-	0	-	-
7	11	2.5	10.0	4	1.1	10.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
8	2	0.5	11.0	1	0.3	12.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
9	1	0.2	12.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Totals	435			357			352			525			242			352			529		
Repeat spawners		55.4			44.3			48.9			28.8			35.9			53.4			50.8	
Female																					
0	110	28.5	3.7	142	50.0	3.8	174	51.8	3.8	285	66.0	3.4	163	63.7	3.9	218	53.6	4.1	215	49.9	4.1
1	84	21.8	4.7	90	31.7	4.6	115	34.2	4.3	119	27.6	4.3	84	32.8	4.1	140	34.4	4.3	131	30.4	4.6
2	81	21.0	5.7	17	6.0	5.5	28	8.3	5.2	23	5.3	5.3	9	3.5	5.2	48	11.8	5.1	69	16.0	5.1
3	27	7.0	6.3	18	6.3	6.6	10	3.0	6.6	3	0.7	6.0	0	-	-	1	0.2	7.0	16	3.7	6.0
4	25	6.5	7.5	4	1.4	7.8	4	1.2	8.3	1	0.2	8.0	0	-	-	0	-	-	0	-	-
5	29	7.5	8.5	4	1.4	8.0	3	0.9	8.0	1	0.2	8.0	0	-	-	0	-	-	0	-	-
6	16	4.2	9.1	5	1.8	9.0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
7	11	2.9	10.3	2	0.7	11.0	1	0.3	10.0	0	-	-	0	-	-	0	-	-	0	-	-
8	2	0.5	11.5	2	0.7	11.5	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
9	0	-	-	0	-	-	1	0.3	12.0	0	-	-	0	-	-	0	-	-	0	-	-
Totals	385			284			336			432			256			407			431		
Repeat spawners		71.5			51.6			48.2			34.0			36.3			46.4			50.1	
Sexes combined																					
Repeat spawners		62.9			46.6			48.5			31.1			36.1			49.7			50.5	

Table 5a. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1982.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	1	0.3	241.0	-	182.0	-
4	0	47	14.8	253.2	10.04	219.6	30.84
4	1	17	5.3	255.7	10.70	223.9	26.02
5	0	108	34.0	267.4	9.66	254.0	28.41
5	1	34	10.7	270.6	8.26	263.1	27.15
5	2	21	6.6	269.9	8.89	259.8	33.63
6	0	7	2.2	272.9	7.80	277.1	22.30
6	1	15	4.7	280.1	9.91	296.0	36.94
6	2	16	5.0	277.4	8.39	293.3	31.87
6	3	11	3.5	278.2	13.30	280.2	40.12
7	1	1	0.3	274.0	-	263.0	-
7	2	5	1.6	287.6	6.39	321.6	40.87
7	3	6	1.9	291.5	6.89	337.2	16.90
7	4	2	0.6	296.0	11.31	367.0	12.73
8	2	1	0.3	305.0	-	364.0	-
8	3	9	2.8	292.3	10.44	343.0	42.55
8	4	5	1.6	285.0	9.38	317.8	26.99
8	5	3	0.9	302.3	4.16	386.0	18.73
9	4	2	0.6	294.0	18.38	336.0	72.12
9	5	6	1.9	301.2	6.68	361.3	33.21
10	7	1	0.3	280.0	-	319.0	-
Female							
4	0	21	6.7	260.1	6.86	246.5	28.41
4	1	8	2.5	261.1	7.90	245.6	12.42
5	0	89	28.3	275.7	8.59	300.4	35.90
5	1	33	10.5	276.6	9.43	304.5	28.38
5	2	21	6.7	282.1	9.25	318.6	43.83
6	0	12	3.8	281.8	8.64	323.3	43.94
6	1	24	7.6	289.6	7.25	343.5	31.45
6	2	14	4.4	291.1	8.93	353.3	46.42
6	3	5	1.6	289.8	11.90	360.8	58.25
7	1	4	1.3	298.3	10.21	380.5	26.86
7	2	10	3.2	300.9	5.42	400.5	34.28
7	3	11	3.5	301.2	18.20	387.4	29.30
7	4	4	1.3	307.0	8.29	416.3	53.62
8	2	1	0.3	298.0	-	372.0	-
8	3	31	9.8	305.5	9.08	417.8	44.95
8	4	7	2.2	309.0	9.57	421.3	53.86
8	5	4	1.3	303.0	9.31	424.3	47.99
9	4	7	2.2	303.9	8.59	414.9	33.19
9	5	2	0.6	301.5	2.12	419.5	3.54
9	6	2	0.6	304.5	6.36	404.0	52.33
10	5	1	0.3	323.0	-	482.0	-
10	7	3	1.0	304.0	19.70	414.0	92.48
11	8	1	0.3	287.0	-	334.0	-

Table 5b. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1983.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	2	0.5	230.0	2.83	166.0	11.31
4	0	45	11.9	249.7	9.90	214.3	28.93
4	1	17	4.5	251.1	10.54	217.7	30.90
5	0	69	18.2	265.9	13.13	261.9	41.52
5	1	67	17.7	270.1	12.06	273.3	39.06
5	2	32	8.4	273.3	14.32	287.0	37.88
6	0	2	0.5	271.0	15.56	266.5	16.26
6	1	36	9.5	277.5	6.52	289.5	28.44
6	2	47	12.4	278.1	9.49	293.9	31.57
6	3	29	7.7	283.1	11.07	310.2	40.68
7	1	1	0.3	297.0	-	360.0	-
7	2	8	2.1	282.9	2.95	306.1	12.98
7	3	11	2.9	285.3	12.34	316.8	43.87
7	4	4	1.1	286.0	13.56	319.5	31.72
8	4	3	0.8	292.7	18.61	345.7	54.24
8	5	3	0.8	287.7	13.58	327.3	27.59
9	5	1	0.3	268.0	-	272.0	-
9	6	1	0.3	268.0	-	261.0	-
12	8	1	0.3	293.0	-	401.0	-
Female							
3	0	1	0.3	217.0	-	146.0	-
4	0	25	6.7	257.3	10.99	243.2	39.19
4	1	15	4.0	252.8	13.45	222.7	41.72
5	0	71	19.1	277.1	13.31	314.3	48.58
5	1	51	13.7	281.1	10.84	323.1	41.03
5	2	25	6.7	279.5	11.16	319.4	49.27
6	0	1	0.3	286.0	-	336.0	-
6	1	50	13.5	287.3	10.88	351.2	48.37
6	2	46	12.4	293.5	10.87	371.4	48.61
6	3	37	10.0	292.7	11.45	364.4	46.76
7	1	3	0.8	299.7	4.16	398.0	3.00
7	2	10	2.7	297.8	8.70	393.9	45.03
7	3	12	3.2	300.5	9.81	403.7	51.90
7	4	2	0.5	287.0	7.07	357.0	35.36
8	2	1	0.3	295.0	-	367.0	-
8	3	2	0.5	301.5	6.36	430.0	4.24
8	4	4	1.1	309.8	19.62	438.5	88.01
8	5	6	1.6	301.8	12.58	406.5	63.54
9	4	2	0.5	304.5	3.54	425.0	18.38
9	5	3	0.8	312.7	5.13	437.3	35.23
9	6	3	0.8	293.0	16.64	359.7	96.02
10	7	1	0.3	276.0	-	294.0	-

Table 5c. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1984.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	1	0.3	223.0	-	150.0	-
4	0	69	19.9	247.7	8.67	206.8	26.24
4	1	31	8.9	241.3	7.73	194.3	29.69
5	0	73	21.0	258.3	7.69	236.5	26.61
5	1	49	14.1	260.8	12.32	247.0	37.03
5	2	30	8.6	267.4	10.93	263.6	37.65
6	0	8	2.3	268.1	9.30	266.9	34.34
6	1	18	5.2	277.3	8.75	303.9	39.32
6	2	23	6.6	276.5	6.22	295.7	21.64
6	3	11	3.2	282.6	7.82	325.4	33.46
7	2	9	2.6	285.3	8.80	328.0	36.98
7	3	11	3.2	288.7	9.73	339.8	50.23
7	4	6	1.7	280.8	9.26	321.2	37.81
8	4	3	0.9	292.0	1.00	362.0	22.54
8	5	3	0.9	286.3	17.04	370.3	36.36
9	4	1	0.3	304.0	-	384.0	-
9	5	1	0.3	302.0	-	379.0	-
Female							
2	0	1	0.3	150.0	-	41.0	-
3	0	1	0.3	210.0	-	119.0	-
4	0	37	9.5	249.7	11.13	221.6	37.02
4	1	19	4.9	250.7	9.80	217.2	27.85
5	0	97	25.0	265.9	10.62	273.1	37.16
5	1	49	12.6	268.3	12.32	284.3	43.96
5	2	36	9.3	272.3	12.69	295.3	43.03
5	3	1	0.3	255.0	-	271.0	-
6	0	13	3.4	278.4	6.22	317.3	31.67
6	1	36	9.3	282.6	10.75	337.9	46.76
6	2	17	4.4	287.5	8.34	343.9	39.96
6	3	12	3.1	285.5	6.59	350.6	41.96
7	1	4	1.0	297.0	7.12	393.3	29.43
7	2	23	5.9	296.5	9.13	389.5	41.29
7	3	7	1.8	291.9	5.43	374.4	32.57
7	4	14	3.6	300.1	10.11	406.7	50.69
8	3	2	0.5	304.5	7.78	416.0	14.14
8	4	11	2.8	303.3	5.53	407.2	32.91
8	5	3	0.8	304.7	11.59	444.7	60.18
9	6	1	0.3	315.0	-	445.0	-
10	5	1	0.3	313.0	-	465.0	-
10	7	2	0.5	308.5	12.02	431.0	2.83
11	8	1	0.3	327.0	-	518.0	-

Table 5d. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1985.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	20	5.8	225.7	7.33	152.8	18.98
4	0	42	12.2	240.2	11.44	186.2	29.94
4	1	40	11.7	248.1	10.84	205.7	28.30
5	0	37	10.8	267.2	8.02	263.9	27.41
5	1	78	22.7	268.1	9.37	260.6	33.82
5	2	44	12.8	267.6	9.26	261.9	29.37
6	0	8	2.3	277.8	10.87	289.4	28.50
6	1	16	4.7	274.4	9.44	281.3	36.22
6	2	21	6.1	274.4	9.39	283.3	29.42
6	3	6	1.7	275.2	15.37	291.2	49.74
7	2	7	2.0	293.6	10.08	346.6	36.16
7	3	13	3.8	288.9	7.83	340.5	29.64
7	4	5	1.5	290.4	11.06	346.0	37.07
8	3	3	0.9	295.0	6.24	363.3	26.35
8	4	1	0.3	298.0	-	360.0	-
8	5	1	0.3	288.0	-	319.0	-
10	6	1	0.3	319.0	-	444.0	-
Female							
3	0	5	1.8	218.4	11.10	143.8	24.51
4	0	17	6.3	247.8	13.01	209.7	34.50
4	1	16	5.9	250.1	8.79	221.1	25.94
5	0	39	14.3	272.6	8.25	288.6	35.30
5	1	53	19.5	275.3	11.59	301.0	38.25
5	2	24	8.8	277.0	7.21	309.0	26.78
6	0	9	3.3	277.3	8.82	306.8	29.55
6	1	32	11.8	287.9	11.49	349.1	45.16
6	2	20	7.4	287.2	8.50	345.6	31.81
6	3	8	2.9	288.8	7.17	356.4	31.58
7	0	1	0.4	288.0	-	351.0	-
7	1	1	0.4	295.0	-	388.0	-
7	2	11	4.0	297.4	13.90	402.7	63.55
7	3	9	3.3	303.3	10.27	414.6	47.55
7	4	6	2.2	297.5	6.66	399.3	28.07
8	2	1	0.4	301.0	-	477.0	-
8	3	8	2.9	308.4	8.68	468.0	52.61
8	4	4	1.5	318.0	16.06	474.0	57.15
8	5	2	0.7	309.5	0.71	449.5	57.28
9	4	1	0.4	310.0	-	452.0	-
9	5	4	1.5	316.0	6.38	471.5	29.06
10	7	1	0.4	306.0	-	401.0	-

Table 5e. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1986.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	1	0.3	221.0	-	143.0	-
4	0	183	47.3	249.2	9.58	206.4	22.93
4	1	139	35.9	250.9	9.09	208.4	22.88
5	0	12	3.1	263.1	7.05	236.9	17.18
5	1	17	4.4	269.2	8.66	252.5	27.63
5	2	11	2.8	268.1	9.06	256.6	27.50
6	1	2	0.5	281.5	16.26	270.5	36.06
6	2	15	3.9	277.9	5.46	284.7	21.89
6	3	4	1.0	275.5	3.70	293.8	13.77
7	3	2	0.5	294.0	1.41	327.5	21.92
9	4	1	0.3	307.0	-	372.0	-
Female							
3	0	1	0.3	233.0	-	170.0	-
4	0	157	52.5	257.1	8.11	236.9	22.71
4	1	90	30.1	258.2	9.22	241.8	27.84
5	0	5	1.7	273.0	7.48	282.2	17.17
5	1	13	4.3	273.5	8.91	287.9	33.24
5	2	13	4.3	273.8	11.50	283.6	45.80
6	1	2	0.7	293.0	9.90	362.0	31.11
6	2	11	3.7	292.1	6.49	344.4	35.08
6	3	5	1.7	291.8	6.65	323.2	42.39
7	2	1	0.3	310.0	-	362.0	-
8	4	1	0.3	300.0	-	383.0	-

Table 5f. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1987.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	2	0.5	218.5	0.71	138.5	2.12
4	0	119	31.4	245.3	6.73	198.0	18.04
4	1	17	4.5	243.5	8.99	197.9	23.20
5	0	46	12.1	261.9	7.81	235.7	24.23
5	1	97	25.6	263.6	8.03	244.1	26.49
5	2	74	19.5	264.0	7.36	244.4	23.26
6	1	5	1.3	272.6	6.50	255.8	20.77
6	2	10	2.6	271.9	8.32	257.6	34.70
6	3	3	0.8	275.0	3.00	279.0	17.69
7	2	2	0.5	286.5	3.54	321.5	12.02
7	3	4	1.1	282.3	19.52	290.8	58.81
Female							
3	0	1	0.3	224.0	-	161.0	-
4	0	112	34.0	251.4	8.56	224.4	25.96
4	1	13	4.0	253.7	10.77	228.3	26.91
5	0	49	14.9	267.8	8.78	272.9	24.51
5	1	81	24.6	270.8	8.16	277.4	28.78
5	2	51	15.5	273.8	8.81	288.1	27.66
6	1	7	2.1	291.1	10.09	343.9	27.56
6	2	6	1.8	284.5	7.77	314.3	28.23
6	3	6	1.8	284.8	4.96	328.3	17.41
7	2	3	0.9	302.7	9.71	377.7	29.02

Table 5g. Mean fork length and weight of alewife, by age and sex, in relation to spawning history, Mactaquac Dam, 1988.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	1	0.3	227.0	-	154.0	-
4	0	56	16.9	238.4	7.57	187.6	19.53
4	1	12	3.6	241.2	6.48	190.0	16.41
5	0	48	14.5	255.9	7.30	233.3	26.07
5	1	76	22.9	258.7	6.22	233.3	22.00
5	2	21	6.3	260.2	7.31	240.7	23.04
6	0	1	0.3	285.0	-	295.0	-
6	1	19	5.7	270.6	5.30	266.4	22.05
6	2	61	18.4	270.8	10.35	262.6	24.90
6	3	29	8.7	267.8	7.24	261.5	27.33
7	2	4	1.2	277.5	5.45	288.0	14.17
7	3	4	1.2	288.0	13.22	291.0	35.54
Female							
3	0	1	0.3	219.0	-	150.0	-
4	0	44	13.9	243.3	7.50	206.3	21.49
4	1	7	2.2	246.1	5.34	215.1	19.42
5	0	73	23.0	263.5	7.63	266.7	26.10
5	1	42	13.2	265.2	6.79	270.2	23.83
5	2	14	4.4	261.8	8.77	250.8	30.50
6	0	1	0.3	290.0	-	345.0	-
6	1	35	11.0	278.5	7.29	312.4	32.59
6	2	69	21.8	279.8	8.05	311.8	33.68
6	3	15	4.7	276.9	8.48	311.9	25.37
7	2	4	1.3	289.3	5.32	328.3	14.01
7	3	9	2.8	287.8	8.88	346.8	30.39
7	4	3	0.9	284.7	12.86	329.7	41.63

Table 6a. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1982.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	143	32.9	202.9	9.29	101.2	15.38
4	0	46	10.6	231.2	13.44	154.9	32.70
4	1	51	11.7	233.5	11.09	160.8	26.40
5	0	5	1.1	254.8	15.80	203.8	38.23
5	1	35	8.0	246.3	12.01	192.2	26.61
5	2	26	6.0	245.5	9.27	195.7	34.29
6	1	2	0.5	256.0	7.07	217.0	2.83
6	2	27	6.2	251.3	8.81	203.2	26.34
6	3	11	2.5	251.6	7.99	208.5	31.34
7	3	7	1.6	258.6	6.16	226.7	19.14
7	4	12	2.8	256.5	6.72	212.5	31.37
8	4	6	1.4	265.3	17.00	247.2	58.62
8	5	22	5.1	263.1	8.88	238.2	36.24
9	4	1	0.2	276.0	-	263.0	-
9	5	5	1.1	266.0	7.78	247.6	29.74
9	6	20	4.6	268.9	7.17	247.5	29.44
10	6	2	0.5	264.5	0.71	228.5	41.72
10	7	11	2.5	266.9	9.58	244.2	19.19
11	8	2	0.5	261.0	1.41	236.0	15.56
12	9	1	0.2	265.0	-	249.0	-
Female							
3	0	36	9.4	210.1	11.12	116.8	19.58
4	0	67	17.4	236.8	12.30	171.2	31.13
4	1	26	6.8	242.0	10.70	187.3	24.87
5	0	7	1.8	249.4	10.95	208.6	24.47
5	1	54	14.0	257.1	9.69	228.9	29.01
5	2	32	8.3	255.4	11.36	219.6	30.45
6	1	4	1.0	264.5	3.51	241.5	27.36
6	2	45	11.7	263.6	7.89	247.5	27.79
6	3	19	4.9	263.7	7.05	250.8	30.20
7	2	4	1.0	270.0	8.83	238.0	34.13
7	3	7	1.8	273.3	8.08	271.3	25.15
7	4	14	3.6	268.1	12.71	256.3	43.50
8	3	1	0.3	275.0	-	327.0	-
8	4	10	2.6	279.1	9.87	302.4	49.94
8	5	15	3.9	275.3	9.26	277.3	35.44
9	4	1	0.3	265.0	-	282.0	-
9	5	14	3.6	278.8	11.09	297.4	39.25
9	6	15	3.9	280.1	12.01	306.7	48.27
10	6	1	0.3	298.0	-	414.0	-
10	7	8	2.1	285.6	6.44	308.3	36.59
11	7	3	0.8	287.3	5.51	287.3	36.90
11	8	1	0.3	295.0	-	335.0	-
12	8	1	0.3	302.0	-	377.0	-

Table 6b. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1983.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
2	0	1	0.3	154.0	-	37.0	-
3	0	137	38.4	201.0	10.70	97.2	18.74
4	0	50	14.0	218.1	15.17	132.4	34.16
4	1	70	19.6	222.1	10.77	138.3	23.13
5	0	12	3.4	236.4	10.09	175.9	35.94
5	1	30	8.4	237.5	12.86	173.7	29.94
5	2	17	4.8	235.1	9.13	174.9	26.00
6	1	1	0.3	271.0	-	274.0	-
6	2	6	1.7	251.2	11.50	212.5	32.61
6	3	5	1.4	242.8	11.30	203.4	31.75
7	3	6	1.7	256.7	12.55	222.3	36.24
7	4	6	1.7	256.3	6.98	221.0	21.82
8	4	2	0.6	261.5	3.54	233.0	5.66
8	5	4	1.1	263.0	5.35	243.5	5.97
9	6	2	0.6	268.5	21.92	252.5	65.76
10	6	3	0.8	265.0	1.73	247.0	10.39
10	7	4	1.1	267.0	9.63	247.3	19.02
12	8	1	0.3	288.0	-	278.0	-
Female							
1	0	2	0.7	98.0	2.83	10.5	0.71
2	0	1	0.4	144.0	-	29.0	-
3	0	49	17.3	211.1	13.50	114.1	21.95
4	0	67	23.6	231.1	12.04	159.5	28.20
4	1	40	14.1	232.9	8.20	166.4	21.16
5	0	21	7.4	246.4	12.82	197.4	34.61
5	1	46	16.2	243.1	8.95	192.3	28.92
5	2	9	3.2	245.6	13.95	198.4	36.37
6	0	2	0.7	242.0	1.41	184.0	-
6	1	4	1.4	246.8	4.72	208.3	15.71
6	2	8	2.8	262.5	7.58	242.0	23.00
6	3	9	3.2	263.3	7.45	241.6	27.14
7	3	8	2.8	267.8	8.17	263.5	24.10
7	4	1	0.4	276.0	-	246.0	-
8	3	1	0.4	280.0	-	313.0	-
8	4	3	1.1	267.0	9.64	281.3	27.10
8	5	4	1.4	277.3	2.99	310.0	17.98
9	6	5	1.8	275.0	8.34	282.4	51.31
11	7	2	0.7	297.5	12.02	344.0	89.10
11	8	1	0.4	272.0	-	240.0	-
12	8	1	0.4	293.0	-	321.0	-

Table 6c. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1984.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	88	25.0	196.8	8.99	90.6	11.74
4	0	88	25.0	220.5	7.38	129.6	16.70
4	1	108	30.7	217.9	6.96	126.1	17.17
5	0	4	1.1	241.8	11.81	182.0	26.94
5	1	20	5.7	232.0	8.45	161.6	21.35
5	2	22	6.3	228.7	10.50	150.1	22.78
6	2	6	1.7	244.7	15.27	193.2	31.90
6	3	7	2.0	242.7	10.01	180.3	23.95
7	3	2	0.6	253.5	0.71	207.5	31.82
7	4	4	1.1	247.5	10.47	190.0	29.02
9	4	1	0.3	268.0	-	241.0	-
9	6	1	0.3	265.0	-	264.0	-
10	6	1	0.3	260.0	-	303.0	-
Female							
3	0	40	11.9	201.2	9.52	96.2	13.37
4	0	122	36.3	227.1	7.67	145.3	17.77
4	1	85	25.3	226.2	7.86	143.7	19.03
4	2	1	0.3	228.0	-	162.0	-
5	0	12	3.6	238.3	11.00	172.1	31.84
5	1	28	8.3	238.3	7.56	179.6	21.65
5	2	21	6.3	237.1	9.75	176.0	29.59
6	1	2	0.6	259.0	22.63	225.5	77.07
6	2	6	1.8	249.0	6.51	208.5	22.16
6	3	5	1.5	255.0	16.17	218.2	51.50
7	3	4	1.2	264.3	5.74	233.8	5.91
7	4	1	0.3	260.0	-	257.0	-
8	3	1	0.3	302.0	-	328.0	-
8	4	1	0.3	265.0	-	290.0	-
8	5	3	0.9	261.0	19.00	246.3	36.86
9	4	2	0.6	285.0	4.24	300.5	45.96
10	7	1	0.3	280.0	-	308.0	-
12	9	1	0.3	302.0	-	330.0	-

Table 6d. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1985.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	332	63.2	191.8	8.48	81.3	12.44
4	0	38	7.2	218.8	12.29	129.7	25.33
4	1	92	17.5	216.6	10.26	126.3	21.26
5	0	3	0.6	226.7	12.70	142.7	18.01
5	1	29	5.5	229.7	8.77	150.2	24.84
5	2	18	3.4	230.1	5.65	158.5	14.63
6	0	1	0.2	252.0	-	212.0	-
6	1	3	0.6	235.0	5.00	164.7	12.50
6	2	3	0.6	242.3	9.07	191.7	31.82
6	3	4	0.8	235.5	13.18	170.8	31.02
7	3	2	0.4	261.5	13.44	224.0	24.04
Female							
3	0	179	41.4	198.8	7.62	90.0	11.18
4	0	94	21.8	227.2	10.00	146.2	22.69
4	1	84	19.4	225.9	9.66	145.2	23.67
5	0	12	2.8	240.9	9.28	177.8	28.46
5	1	33	7.6	235.2	12.00	164.2	31.88
5	2	17	3.9	237.9	9.18	171.3	26.00
6	1	2	0.5	247.5	10.61	205.0	31.11
6	2	6	1.4	249.2	12.42	203.7	37.23
6	3	3	0.7	252.7	1.53	227.0	16.46
8	4	1	0.2	280.0	-	313.0	-
8	5	1	0.2	280.0	-	313.0	-

Table 6e. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1986.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	85	35.1	193.0	10.09	84.2	13.24
4	0	70	28.9	214.9	9.97	118.7	21.99
4	1	68	28.1	211.4	9.38	113.3	17.52
5	1	6	2.5	229.8	9.62	147.2	28.65
5	2	9	3.7	234.4	16.55	159.1	42.11
6	2	2	0.8	246.5	9.19	172.0	33.94
6	3	2	0.8	246.0	0.00	176.0	5.66
Female							
3	0	18	7.0	198.3	8.31	91.7	11.53
4	0	144	56.3	221.9	8.86	132.3	18.80
4	1	79	30.9	220.2	8.02	128.5	17.06
5	0	1	0.4	237.0	-	172.0	-
5	1	5	2.0	245.4	8.20	184.2	17.34
5	2	7	2.7	239.9	17.08	177.7	44.31
6	2	2	0.8	247.5	17.68	199.5	31.82

Table 6f. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1987.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	41	11.6	192.6	9.26	82.1	16.40
4	0	120	34.1	210.7	9.38	109.3	18.25
4	1	129	36.6	210.1	9.73	110.2	16.87
5	0	3	0.9	236.0	7.21	155.0	14.73
5	1	16	4.5	223.6	8.25	136.5	17.77
5	2	38	10.8	220.2	10.39	127.5	21.33
6	2	3	0.9	243.0	12.17	180.3	26.27
7	3	1	0.3	256.0	-	227.0	-
7	4	1	0.3	247.0	-	183.0	-
Female							
3	0	16	3.9	196.6	8.57	87.4	12.86
4	0	172	42.3	215.3	8.60	119.6	16.23
4	1	106	26.0	216.0	8.15	122.0	15.40
5	0	30	7.4	238.7	9.89	171.1	23.51
5	1	33	8.1	235.1	8.52	163.7	21.69
5	2	44	10.8	236.0	8.17	164.1	21.93
6	1	1	0.2	262.0	-	203.0	-
6	2	4	1.0	248.3	8.62	193.5	31.64
7	3	1	0.2	255.0	-	216.0	-

Table 6g. Mean fork length and weight of blueback herring, by age and sex, in relation to spawning history, Mactaquac Dam, 1988.

Age (yr)	No. previous spawnings	N	%	Mean length (mm)	SD	Mean weight (g)	SD
Male							
3	0	121	22.9	187.8	6.22	75.8	9.14
4	0	132	25.0	207.8	9.32	107.6	18.41
4	1	110	20.8	207.8	6.48	108.7	14.03
5	0	6	1.1	221.8	10.53	131.3	15.85
5	1	49	9.3	220.0	7.16	129.9	14.94
5	2	95	18.0	216.5	9.42	123.3	18.98
6	0	1	0.2	249.0	-	199.0	-
6	2	6	1.1	239.8	16.44	177.8	46.47
6	3	9	1.7	226.6	11.10	142.4	28.48
Female							
3	0	20	4.6	193.5	6.30	83.9	8.66
4	0	156	36.2	215.0	9.59	123.0	20.59
4	1	55	12.8	216.2	9.26	124.2	19.88
5	0	39	9.0	231.6	7.47	162.6	22.09
5	1	71	16.5	230.7	9.09	159.6	27.56
5	2	61	14.2	228.8	10.09	153.9	22.38
6	1	5	1.2	248.6	6.80	213.6	20.01
6	2	8	1.9	241.1	8.90	180.9	27.92
6	3	16	3.7	240.9	8.92	178.6	25.12

Table 7. Age at first spawning (maturity) of alewife, by sex and year, Mactaquac Dam, 1982 - 1988.

Age at first spawning (yr)	1982				1983				1984				1985			
	Male		Female		Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
3	56	17.6	48	15.2	93	24.5	98	26.4	89	25.7	95	24.5	118	34.4	63	23.3
4	114	35.9	88	27.9	171	45.1	135	36.4	149	42.9	117	30.2	154	44.9	104	38.5
5	139	43.7	162	51.4	112	29.6	132	36.4	101	29.1	158	40.7	63	18.4	91	33.7
6	9	2.8	17	5.4	3	0.8	3	0.8	8	2.3	17	4.4	8	2.3	11	4.1
7	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	0.4
Total	318		315		379		371		347		387		343		270	
Mean age	4.3		4.5		4.1		4.1		4.1		4.2		3.9		4.2	
SD	0.79		0.82		0.76		0.80		0.80		0.88		0.78		0.86	

Age at first spawning (yr)	1986				1987				1988			
	Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%
3	155	40.1	109	36.5	96	25.3	71	21.6	63	19.0	39	12.5
4	217	56.1	182	60.9	232	61.2	200	60.8	197	59.3	161	51.4
5	15	3.9	8	2.7	51	13.5	58	17.6	71	21.4	112	35.8
6	0	-	0	-	0	-	0	-	1	0.3	1	0.3
7	0	-	0	-	0	-	0	-	0	-	0	-
Total	387		299		379		329		332		313	
Mean age	3.6		3.7		3.9		4.0		4.0		4.2	
SD	0.56		0.53		0.61		0.63		0.65		0.66	

Table 8. Age at first spawning (maturity) of blueback herring, by sex and year, Mactaquac Dam, 1982 - 1988.

Age at first spawning (yr)	1982				1983				1984				1985			
	Male		Female		Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
3	299	68.7	166	43.1	247	69.4	121	43.1	232	65.9	160	47.6	445	85.1	275	65.2
4	128	29.4	202	52.5	96	27.0	132	47.0	115	32.7	159	47.3	71	13.6	133	31.5
5	8	1.8	17	4.4	13	3.6	26	9.2	5	1.4	17	5.1	6	1.1	14	3.3
6	0	-	0	-	0	-	2	0.7	0	-	0	-	1	0.2	0	-
Total	435		385		356		281		352		336		523		422	
Mean age	3.3		3.6		3.3		3.7		3.4		3.6		3.2		3.4	
SD	0.51		0.57		0.55		0.67		0.51		0.59		0.42		0.55	

Age at first spawning (yr)	1986				1987				1988			
	Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%
3	164	67.8	101	39.9	209	59.4	168	41.3	335	63.3	152	35.4
4	78	32.2	151	59.7	140	39.8	209	51.3	187	35.4	234	54.4
5	0	-	1	0.4	3	0.9	30	7.4	6	1.1	44	10.2
6	0	-	0	-	0	-	0	-	1	0.2	0	-
Total	242		253		352		407		529		430	
Mean age	3.3		3.6		3.4		3.7		3.4		3.8	
SD	0.47		0.50		0.51		0.61		0.52		0.63	

Table 9. Length-frequency distribution of mature alewife, by sex and year, Mactaquac Dam, 1982 - 1988.

Fork length (mm)	1982				1983				1984				1985			
	Male		Female		Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
200-209	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
210-219	0	-	0	-	1	0.2	1	0.3	0	-	2	0.5	4	1.1	0	-
220-229	0	-	0	-	6	1.5	2	0.5	6	1.6	2	0.5	20	5.7	3	1.1
230-239	6	1.9	0	-	3	0.7	1	0.3	19	5.2	5	1.2	26	7.4	6	2.2
240-249	21	6.5	2	0.6	27	6.5	6	1.5	62	17.0	23	5.7	19	5.4	10	3.6
250-259	41	12.7	15	4.6	57	13.8	24	6.0	87	23.8	61	15.1	60	17.1	18	6.5
260-269	90	27.8	44	13.6	73	17.7	37	9.3	67	18.4	79	19.6	76	21.7	37	13.4
270-279	83	25.6	64	19.8	117	28.3	62	15.5	60	16.4	68	16.8	80	22.8	55	19.9
280-289	47	14.5	71	21.9	84	20.3	111	27.8	40	11.0	67	16.6	37	10.5	65	23.5
290-299	25	7.7	52	16.1	35	8.5	84	21.1	20	5.5	52	12.9	20	5.7	38	13.7
300-309	11	3.4	47	14.5	8	1.9	46	11.5	3	0.8	32	7.9	7	2.0	25	9.0
310-319	0	-	24	7.4	2	0.5	18	4.5	1	0.3	11	2.7	2	0.6	13	4.7
320-329	0	-	3	0.9	0	-	6	1.5	0	-	1	0.3	0	-	6	2.2
330-339	0	-	1	0.3	0	-	1	0.3	0	-	0	-	0	-	1	0.4
340-349	0	-	1	0.3	0	-	0	-	0	-	0	-	0	-	0	-
Total	324		324		413		399		365		404		351		277	

Fork length (mm)	1986				1987				1988			
	Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%
200-209	0	-	0	-	0	-	0	-	0	-	0	-
210-219	1	0.3	0	-	2	0.5	0	-	1	0.3	1	0.3
220-229	10	2.6	1	0.3	3	0.8	1	0.3	9	2.6	2	0.6
230-239	29	7.4	4	1.3	31	8.0	11	3.3	21	6.1	10	3.0
240-249	91	23.2	31	10.2	73	18.9	39	11.5	50	14.4	28	8.5
250-259	153	39.0	107	35.2	90	23.3	67	19.8	79	22.8	49	14.8
260-269	66	16.8	98	32.2	123	31.9	83	24.6	106	30.6	71	21.5
270-279	28	7.1	33	10.9	55	14.3	79	23.4	61	17.6	87	26.3
280-289	9	2.3	12	4.0	8	2.1	46	13.6	16	4.6	62	18.7
290-299	4	1.0	13	4.3	0	-	8	2.4	2	0.6	20	6.0
300-309	1	0.3	4	1.3	1	0.3	2	0.6	1	0.3	1	0.3
310-319	0	-	1	0.3	0	-	2	0.6	0	-	0	-
320-329	0	-	0	-	0	-	0	-	1	0.3	0	-
330-339	0	-	0	-	0	-	0	-	0	-	0	-
340-349	0	-	0	-	0	-	0	-	0	-	0	-
Total	392		304		386		338		347		331	

Table 10. Length-frequency distribution of mature blueback herring, by sex and year, Mactaquac Dam, 1982 - 1988.

Fork length (mm)	1982				1983				1984				1985			
	Male		Female		Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
160-169	0	-	0	-	0	-	0	-	0	-	0	-	1	0.2	0	-
170-179	0	-	0	-	1	0.3	0	-	1	0.3	0	-	13	2.5	0	-
180-189	5	1.1	1	0.3	8	2.1	1	0.3	19	5.4	3	0.9	110	20.9	13	3.0
190-199	54	11.9	2	0.5	66	17.4	8	2.7	35	9.9	13	3.8	160	30.4	89	20.8
200-209	53	11.7	15	3.8	65	17.1	25	8.3	39	11.0	22	6.4	57	10.8	63	14.8
210-219	39	8.6	19	4.8	52	13.7	15	5.0	101	28.5	34	9.9	75	14.3	43	10.1
220-229	35	7.7	14	3.5	61	16.1	43	14.2	92	26.0	107	31.1	50	9.5	83	19.4
230-239	41	9.0	40	10.1	43	11.3	60	19.9	43	12.2	99	28.8	43	8.2	79	18.5
240-249	73	16.0	50	12.7	37	9.7	63	20.9	8	2.3	31	9.0	12	2.3	38	8.9
250-259	70	15.4	71	18.0	19	5.0	33	10.9	12	3.4	14	4.1	4	0.8	14	3.3
260-269	53	11.7	86	21.8	15	4.0	24	8.0	3	0.9	10	2.9	0	-	2	0.5
270-279	25	5.5	50	12.7	10	2.6	13	4.3	1	0.3	2	0.6	1	0.2	1	0.2
280-289	5	1.1	34	8.6	3	0.8	10	3.3	0	-	7	2.0	0	-	2	0.5
290-299	2	0.4	11	2.8	0	-	5	1.7	0	-	0	-	0	-	0	-
300-309	0	-	2	0.5	0	-	1	0.3	0	-	2	0.6	0	-	0	-
310-319	0	-	0	-	0	-	1	0.3	0	-	0	-	0	-	0	-
Total	455		395		380		302		354		344		526		427	

Fork length (mm)	1986				1987				1988			
	Male		Female		Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%
160-169	0	-	0	-	0	-	0	-	0	-	0	-
170-179	8	3.3	0	-	1	0.3	0	-	7	1.2	0	-
180-189	22	9.0	2	0.8	19	5.4	4	1.0	66	11.7	6	1.3
190-199	32	13.1	7	2.8	46	13.0	10	2.4	78	13.8	19	4.2
200-209	76	31.2	16	6.3	91	25.6	72	17.1	141	25.0	54	11.9
210-219	53	21.7	93	36.5	111	31.3	132	31.4	160	28.4	102	22.5
220-229	31	12.7	81	31.8	61	17.2	83	19.7	77	13.7	120	26.5
230-239	14	5.7	42	16.5	21	5.9	71	16.9	27	4.8	101	22.3
240-249	6	2.5	10	3.9	3	0.9	36	8.6	7	1.2	37	8.2
250-259	1	0.4	2	0.8	2	0.6	10	2.4	0	-	12	2.7
260-269	0	-	1	0.4	0	-	3	0.7	1	0.2	2	0.4
270-279	1	0.4	1	0.4	0	-	0	-	0	-	0	-
280-289	0	-	0	-	0	-	0	-	0	-	0	-
290-299	0	-	0	-	0	-	0	-	0	-	0	-
300-309	0	-	0	-	0	-	0	-	0	-	0	-
310-319	0	-	0	-	0	-	0	-	0	-	0	-
Total	244		255		355		421		564		453	

Table 11. Mean weight (g) of alewife by sex, age and year, Mactaquac Dam, 1982 - 1988.

		Male				Female			
Year	Age	N	Mean	Range	SD	N	Mean	Range	SD
1982	3	1	182.0	182-182	-	0	-	-	-
	4	64	220.7	165-336	29.50	29	246.2	208-298	24.80
	5	163	256.7	164-346	28.94	143	304.0	214-406	35.93
	6	49	288.9	211-343	34.25	55	343.1	262-435	41.57
	7	14	330.6	252-376	35.25	29	394.9	333-467	34.61
	8	18	344.3	282-426	40.02	43	417.9	317-508	45.59
	9	8	355.0	285-397	40.85	11	413.7	367-474	31.03
	10	1	319.0	319-319	-	4	431.0	310-487	82.81
	11	0	-	-	-	1	334.0	334-334	-
1983	3	3	167.7	158-178	8.50	1	146.0	146-146	-
	4	61	216.0	136-280	28.94	44	250.5	145-467	63.14
	5	166	271.6	165-384	40.63	140	315.0	209-477	43.58
	6	114	294.7	201-400	36.03	132	361.1	258-505	48.46
	7	24	315.5	269-430	33.76	27	396.0	326-502	45.13
	8	6	331.5	254-386	48.60	13	416.9	307-530	63.76
	9	2	266.5	261-272	7.78	7	395.9	295-478	66.53
	10	0	-	-	-	1	294.0	294-294	-
	11	0	-	-	-	0	-	-	-
	12	1	401.0	401-401	-	0	-	-	-
1984	3	1	150.0	150-150	-	1	119.0	119-119	-
	4	100	202.9	143-304	27.82	56	220.1	128-318	33.99
	5	152	245.2	176-344	33.93	183	280.4	204-403	40.88
	6	60	299.8	229-376	35.08	78	337.7	224-429	42.87
	7	26	331.4	280-478	42.34	48	392.7	302-479	42.58
	8	6	366.2	336-412	27.44	16	415.3	358-514	37.94
	9	2	381.5	379-384	3.54	1	445.0	445-445	-
	10	0	-	-	-	3	442.3	429-465	19.73
	11	0	-	-	-	1	518.0	518-518	-
1985	3	20	152.8	117-183	18.98	3	160.0	146-175	14.53
	4	82	195.7	132-270	30.59	33	215.2	141-262	30.73
	5	159	261.7	186-381	31.07	116	298.5	227-381	35.72
	6	51	284.6	204-351	33.38	69	343.4	268-418	40.39
	7	25	343.3	273-404	31.69	28	403.4	288-507	49.67
	8	5	353.8	319-385	26.98	15	467.7	392-546	48.82
	9	0	-	-	-	5	467.6	441-504	26.63
	10	1	444.0	444-444	-	1	401.0	401-401	-
1986	3	1	143.0	143-143	-	1	170.0	170-170	-
	4	322	207.3	123-283	22.90	247	238.7	132-311	24.76
	5	40	249.0	203-310	25.63	31	285.2	204-362	36.41
	6	21	285.1	238-326	21.57	18	340.4	262-403	36.82
	7	2	327.5	312-343	21.92	1	362.0	362-362	-
	8	0	-	-	-	1	383.0	383-383	-
	9	1	372.0	372-372	-	0	-	-	-
1987	3	2	138.5	137-140	2.12	1	161.0	161-161	-
	4	136	198.0	150-248	18.66	125	224.8	175-298	25.98
	5	217	242.0	178-337	25.09	181	279.2	184-348	27.85
	6	18	260.7	222-324	29.11	19	329.6	265-386	26.76
	7	6	301.0	250-377	48.54	3	377.7	348-406	29.02
1988	3	1	154.0	154-154	-	1	150.0	150-150	-
	4	68	188.0	144-227	18.93	50	207.0	163-246	21.13
	5	145	234.4	178-306	23.55	129	266.2	188-340	26.29
	6	110	263.3	189-321	25.01	117	312.4	224-400	32.54
	7	8	289.5	253-335	25.10	16	338.9	278-380	29.11

Table 12. Mean weight (g) of blueback herring by sex, age and year, Mactaquac Dam, 1982 - 1988.

		Male				Female			
Year	Age	N	Mean	Range	SD	N	Mean	Range	SD
1982	3	143	101.2	73-160	15.38	36	116.8	80-160	19.58
	4	97	158.0	92-244	29.55	93	175.7	107-286	30.26
	5	66	194.4	129-311	30.38	93	224.2	148-305	29.58
	6	40	205.3	147-274	26.98	68	248.1	192-322	28.12
	7	19	217.7	170-291	27.80	25	257.6	188-333	38.06
	8	28	240.1	173-337	40.89	26	288.9	220-386	42.57
	9	26	248.1	199-309	28.45	30	301.5	232-416	43.02
	10	13	241.8	199-277	22.06	9	320.0	269-414	49.13
	11	2	236.0	225-247	15.56	4	299.3	256-335	38.41
	12	1	249.0	249-249	-	1	377.0	377-377	-
1983	3	136	97.2	65-172	18.80	49	114.1	85-169	21.95
	4	120	135.9	78-245	28.27	107	162.1	79-242	25.91
	5	60	176.1	131-268	31.80	79	200.7	130-413	44.74
	6	13	218.9	161-279	38.12	25	244.2	184-407	54.02
	7	12	221.7	170-269	28.53	9	261.6	231-296	23.29
	8	6	240.0	229-249	7.56	8	299.6	253-327	24.06
	9	2	252.5	206-299	65.76	6	313.7	223-470	89.29
	10	7	247.1	229-273	14.73	0	-	-	-
	11	0	-	-	-	3	309.3	240-407	87.03
	12	1	278.0	278-278	-	1	321.0	321-321	-
1984	3	88	90.6	66-125	11.74	40	96.2	76-123	13.37
	4	196	127.7	82-204	17.01	208	144.7	99-206	18.27
	5	46	157.9	113-218	23.89	61	176.9	132-262	26.40
	6	13	186.2	155-254	27.48	13	214.9	171-293	40.34
	7	6	195.8	164-230	28.10	5	238.4	229-257	11.59
	8	0	-	-	-	5	271.4	218-328	45.14
	9	2	252.5	241-264	16.26	2	300.5	268-333	45.96
	10	1	303.0	303-303	-	1	308.0	308-308	-
	11	0	-	-	-	0	-	-	-
	12	0	-	-	-	1	330.0	330-330	-
1985	3	330	81.4	48-149	12.47	170	90.3	65-122	10.99
	4	130	127.3	78-215	22.48	177	145.9	87-203	22.97
	5	50	152.8	104-208	21.50	62	168.8	104-250	29.76
	6	11	178.6	125-212	27.71	11	210.3	161-259	30.98
	7	2	224.0	207-241	24.04	0	-	-	-
	8	0	-	-	-	2	313.0	313-313	0.00
1986	3	85	84.2	58-125	13.24	15	92.9	73-112	12.00
	4	138	116.1	81-196	20.03	223	130.9	88-199	18.25
	5	15	154.3	114-258	36.65	13	179.8	120-255	33.13
	6	4	174.0	148-196	20.00	2	199.5	177-222	31.82
1987	3	41	82.1	64-138	16.40	16	87.4	71-110	12.86
	4	249	109.8	73-170	17.52	278	120.5	84-166	15.94
	5	57	131.5	96-189	20.99	107	165.9	111-220	22.34
	6	3	180.3	160-210	26.27	5	195.4	171-239	27.73
	7	2	205.0	183-227	31.11	1	216.0	216-216	-
1988	3	121	75.8	55-98	9.14	20	83.9	72-100	8.66
	4	242	108.1	81-162	16.54	210	123.4	85-185	20.39
	5	150	125.8	88-164	17.85	171	158.2	104-258	24.71
	6	16	159.3	103-251	39.57	29	185.2	137-235	27.65

Table 13. Mean fork length (mm) of alewife, by sample date and year, Mactaquac Dam, 1982 - 1988 (sexes combined).

1982				1983				1984			
Date	N	Mean	SD	Date	N	Mean	SD	Date	N	Mean	SD
18 May	100	296.5	15.32	17 May	100	286.7	14.30	17 May	100	285.8	16.96
21 May	100	283.3	14.14	19 May	100	287.8	17.46	22 May	100	277.3	18.63
25 May	100	278.9	15.71	23 May	100	280.7	12.99	25 May	100	273.0	15.82
28 May	97	274.6	13.37	26 May	90	288.5	14.52	28 May	99	266.8	15.48
1 Jun	82	270.4	13.29	30 May	99	275.1	15.67	31 May	93	268.8	13.46
4 Jun	83	271.2	12.38	2 Jun	100	275.2	14.42	5 Jun	99	262.9	16.33
8 Jun	19	271.6	17.55	6 Jun	66	268.4	13.61	8 Jun	47	260.2	18.14
11 Jun	23	270.4	17.25	9 Jun	68	270.6	14.20	11 Jun	61	255.6	14.80
15 Jun	5	260.4	22.79	13 Jun	50	262.2	14.31	14 Jun	17	258.4	18.00
22 Jun	4	267.3	24.10	16 Jun	20	266.3	18.80	18 Jun	7	253.4	20.93
25 Jun	10	249.3	7.32	20 Jun	8	244.6	19.86	21 Jun	7	247.3	20.29
29 Jun	7	257.0	11.94	30 Jun	7	243.7	9.52	25 Jun	10	239.3	36.69
2 Jul	17	259.1	10.85	4 Jul	4	190.0	58.72	29 Jun	5	252.2	11.26
								3 Jul	23	246.8	9.73

1985				1986				1987			
Date	N	Mean	SD	Date	N	Mean	SD	Date	N	Mean	SD
16 May	100	282.1	14.79	15 May	100	256.8	11.22	15 May	100	262.6	13.72
17 May	99	282.9	18.16	20 May	100	261.3	14.27	19 May	100	262.8	11.68
21 May	100	277.8	17.55	23 May	99	265.2	13.01	22 May	100	263.6	14.61
24 May	100	268.7	17.36	27 May	100	256.1	12.51	25 May	93	255.6	13.38
27 May	98	264.0	17.83	30 May	98	255.9	11.62	28 May	82	264.2	15.79
30 May	85	257.5	21.37	2 Jun	80	255.4	12.71	1 Jun	67	258.3	13.81
3 Jun	29	244.7	20.16	6 Jun	36	252.9	14.64	4 Jun	11	253.9	15.21
6 Jun	4	268.0	30.47	9 Jun	23	247.5	9.25	8 Jun	36	260.8	14.44
10 Jun	7	255.9	23.84	12 Jun	3	237.0	13.89	11 Jun	19	251.5	14.63
13 Jun	2	239.5	47.38	16 Jun	6	237.5	12.79	15 Jun	12	251.6	13.36
21 Jun	2	214.5	10.61	20 Jun	49	250.8	14.55	18 Jun	3	246.3	7.77
2 Jul	4	229.5	9.26	23 Jun	2	247.0	5.66				

1988			
Date	N	Mean	SD
10 May	100	271.8	11.39
13 May	99	267.8	12.73
16 May	100	265.4	13.16
20 May	99	265.7	13.37
24 May	97	261.4	15.70
27 May	91	257.3	16.67
30 May	53	257.0	15.55
2 Jun	12	255.0	13.60
6 Jun	4	256.3	10.84
9 Jun	7	250.3	21.62
13 Jun	16	239.4	11.55
17 Jun	3	244.3	15.95

Table 14. Mean fork length (mm) of blueback herring, by sample date and year, Mactaquac Dam, 1982 - 1988 (sexes combined).

1982

Date	N	Mean	SD
28 May	3	271.7	10.40
1 Jun	18	265.3	15.40
4 Jun	17	255.0	12.90
8 Jun	79	261.8	17.48
11 Jun	77	261.3	15.00
15 Jun	95	252.9	20.50
18 Jun	99	250.2	20.19
22 Jun	96	253.8	18.38
25 Jun	90	241.1	22.51
29 Jun	93	232.6	24.99
2 Jul	83	224.6	24.54
6 Jul	100	210.7	19.39

1983

Date	N	Mean	SD
26 May	10	285.4	12.49
6 Jun	34	237.1	13.39
9 Jun	32	253.2	18.35
13 Jun	50	239.5	11.37
16 Jun	80	243.2	18.24
20 Jun	92	228.2	20.67
23 Jun	100	237.1	20.57
27 Jun	99	220.5	23.56
30 Jun	93	214.7	24.13
4 Jul	96	205.7	24.27

1984

Date	N	Mean	SD
31 May	7	242.9	19.40
8 Jun	53	234.5	16.29
11 Jun	39	226.2	13.27
14 Jun	83	227.3	13.52
18 Jun	93	224.8	12.63
21 Jun	93	223.3	20.09
25 Jun	90	215.3	20.38
29 Jun	95	223.0	21.61
3 Jul	77	214.5	14.43
6 Jul	66	222.9	17.35

1985

Date	N	Mean	SD
27 May	2	247.5	2.12
30 May	15	245.2	10.15
3 Jun	71	231.6	10.81
6 Jun	96	224.8	17.08
10 Jun	92	216.7	18.68
13 Jun	98	214.0	19.55
17 Jun	100	206.2	18.49
21 Jun	96	197.8	15.75
24 Jun	100	204.1	17.98
27 Jun	100	205.1	17.46
2 Jul	94	200.8	11.42
5 Jul	100	196.0	12.04

1986

Date	N	Mean	SD
30 May	2	253.0	28.28
2 Jun	20	229.3	17.26
6 Jun	64	222.7	9.54
9 Jun	77	214.2	16.08
12 Jun	97	215.1	14.80
16 Jun	93	208.6	14.65
20 Jun	50	211.5	13.93
23 Jun	98	211.9	14.50

1987

Date	N	Mean	SD
25 May	7	229.0	12.48
28 May	18	228.2	15.70
1 Jun	33	219.9	9.66
4 Jun	89	223.8	13.56
8 Jun	64	221.2	11.93
11 Jun	81	217.2	13.05
15 Jun	88	213.8	14.19
18 Jun	97	217.7	12.04
22 Jun	100	214.0	16.53
25 Jun	99	209.8	14.03
29 Jun	100	212.0	14.56

1988

Date	N	Mean	SD
24 May	3	234.7	11.01
27 May	9	231.1	14.26
30 May	47	227.2	10.80
2 Jun	88	224.7	10.57
6 Jun	96	219.5	13.85
9 Jun	93	221.9	12.76
13 Jun	84	213.7	14.48
17 Jun	97	218.2	14.54
20 Jun	100	212.6	15.49
23 Jun	100	206.0	15.48
27 Jun	100	208.0	16.73
30 Jun	100	206.4	15.05
4 Jul	100	205.0	14.82

Table 15a. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1982 (sexes combined).

Fork length (mm)	Age									Total
	3	4	5	6	7	8	9	10	11	
230-239		5	1							6
240-249	1	19	3							23
250-259		35	20	1						56
260-269		27	97	10						134
270-279		7	107	25	1	2				142
280-289			65	35	8	4	1	2	1	116
290-299			11	25	14	19	5			74
300-309			2	8	15	19	11			55
310-319					4	15	2	1		22
320-329						1		2		3
330-339						1				1
340-349					1					1
Total	1	93	306	104	43	61	19	5	1	633
Percent	0.2	14.7	48.3	16.4	6.8	9.6	3.0	0.8	0.2	

Table 15b. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1983 (sexes combined).

Fork length (mm)	Age										Total
	3	4	5	6	7	8	9	10	11	12	
210-219	1	1									2
220-229	1	4	2								7
230-239	1	3									4
240-249		26	6								32
250-259		44	35	2							81
260-269		18	71	14	2		2				107
270-279		6	98	59	3	2		1			169
280-289			65	85	16	3	2				171
290-299			29	54	17	5				1	106
300-309			7	25	9	4	3				48
310-319			1	7	4	4	3				19
320-329			1	2							3
330-339						1					1
Total	3	102	315	248	51	19	10	1	0	1	750
Percent	0.4	13.6	42.0	33.1	6.8	2.5	1.3	0.1	0.0	0.1	

Table 15c. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1984 (sexes combined).

Fork length (mm)	Age										Total
	2	3	4	5	6	7	8	9	10	11	
150-159	1										1
160-169											0
170-179											0
180-189											0
190-199											0
200-209											0
210-219		1	1								2
220-229		1	6	1							8
230-239			22	1							23
240-249			65	18							83
250-259			45	96	3						144
260-269			15	112	14						141
270-279			2	68	40	9	1				120
280-289				29	55	18	1				103
290-299				8	24	25	8				65
300-309				2	2	18	8	2	1		33
310-319						4	4	1	2		11
320-329										1	1
Total	1	2	156	335	138	74	22	3	3	1	735
Percent	0.1	0.3	21.2	45.6	18.8	10.1	3.0	0.4	0.4	0.1	

Table 15d. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1985 (sexes combined).

Fork length (mm)	Age									Total
	2	3	4	5	6	7	8	9	10	
140-149	1									1
150-159										0
160-169	1									1
170-179	1									1
180-189										0
190-199										0
200-209		3								3
210-219		4								4
220-229		12	11							23
230-239		7	25							32
240-249			26	2	1					29
250-259			42	32	3					77
260-269			11	86	14	1				112
270-279				103	28	3				134
280-289				43	42	13	2			100
290-299				7	22	18	5			52
300-309				2	10	11	6		1	30
310-319						6	4	3	1	14
320-329						1	2	2		5
330-339							1			1
Total	3	26	115	275	120	53	20	5	2	619
Percent	0.5	4.2	18.6	44.4	19.4	8.6	3.2	0.8	0.3	

Table 15e. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1986 (sexes combined).

Fork length (mm)	Age								Total
	2	3	4	5	6	7	8	9	
150-159	1								1
160-169									0
170-179									0
180-189									0
190-199									0
200-209									0
210-219		1	1						2
220-229		1	10						11
230-239		1	31						32
240-249			121						121
250-259			248	8					256
260-269			135	26	1				162
270-279			22	24	15				61
280-289			1	12	8				21
290-299				1	12	2			15
300-309					3		1	1	5
310-319						1			1
Total	1	3	569	71	39	3	1	1	688
Percent	0.1	0.4	82.7	10.3	5.7	0.4	0.1	0.1	

Table 15f. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1987 (sexes combined).

Fork length (mm)	Age 3	4	5	6	7	Total
210-219	2					2
220-229	1	3				4
230-239		41	1			42
240-249		103	9			112
250-259		89	66	1		156
260-269		23	174	3	1	201
270-279		2	113	13	1	129
280-289			33	14	3	50
290-299			2	5	1	8
300-309					2	2
310-319				1	1	2
Total	3	261	398	37	9	708
Percent	0.4	36.9	56.2	5.2	1.3	

Table 15g. Length-frequency distribution of alewife, by age, Mactaquac Dam, 1988 (sexes combined).

Fork length (mm)	Age 3	4	5	6	7	Total
210-219	1	1				2
220-229	1	10				11
230-239		31				31
240-249		64	13	1		78
250-259		13	106	6		125
260-269			115	54		169
270-279			38	94	5	137
280-289			2	62	10	74
290-299				11	8	19
300-309				1	1	2
310-319						0
320-329				1		1
Total	2	119	274	230	24	649
Percent	0.3	18.3	42.2	35.4	3.7	

Table 16a. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1982 (sexes combined).

Fork length (mm)	Age										Total
	3	4	5	6	7	8	9	10	11	12	
180-189	6										6
190-199	56										56
200-209	64	4									68
210-219	38	20									58
220-229	11	32	5								48
230-239	4	58	14	3							79
240-249		52	46	13	3	2					116
250-259		21	49	36	12	7	5	3			133
260-269		3	38	42	15	16	12	5	2	1	134
270-279			5	14	7	18	21	5			70
280-289			2		7	7	14	6	2		38
290-299						4	3	3	2		12
300-309							1			1	2
Total	179	190	159	108	44	54	56	22	6	2	820
Percent	21.8	23.2	19.4	13.2	5.4	6.6	6.8	2.7	0.7	0.2	

Table 16b. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1983 (sexes combined).

Fork length (mm)	Age												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
90- 99	1												1
100-109	1												1
110-119													0
120-129													0
130-139													0
140-149		1											1
150-159		1											1
160-169													0
170-179			1										1
180-189			9										9
190-199			63	9									72
200-209			71	14									85
210-219			20	42	2								64
220-229			12	65	22	1							100
230-239			8	63	29		1						101
240-249			2	30	48	12	1						93
250-259				3	27	7	7	2	1	1			48
260-269				1	5	12	7	4	2	4			35
270-279					1	2	4	6	1	2	1		17
280-289					1	1	1	2	3		1	1	10
290-299												1	1
300-309											1		1
Total	2	2	186	227	135	35	21	14	7	7	3	2	641
Percent	0.3	0.3	29.0	35.4	21.1	5.5	3.3	2.2	1.1	1.1	0.5	0.3	

Table 16c. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1984 (sexes combined).

Fork length (mm)	Age										Total
	3	4	5	6	7	8	9	10	11	12	
170-179	1										1
180-189	22										22
190-199	47	1									48
200-209	44	15	1								60
210-219	12	117	6								135
220-229	2	178	18								198
230-239		85	48	8	1						142
240-249		6	24	5	1	1					37
250-259		2	9	9	5						25
260-269			1	1	4	2	2	1			11
270-279				2							2
280-289				1		1	2	1			5
290-299											0
300-309						1				1	2
Total	128	404	107	26	11	5	4	2	0	1	688
Percent	18.6	58.7	15.6	3.8	1.6	0.7	0.6	0.3	0.0	0.1	

Table 16d. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1985 (sexes combined).

Fork length (mm)	Age 3	4	5	6	7	8	Total
160-169	1						1
170-179	14						14
180-189	123	1					124
190-199	248	7					255
200-209	95	27					122
210-219	30	80	9	1			120
220-229	1	102	29				132
230-239		73	44	5			122
240-249		16	21	9			46
250-259		2	8	6	1		17
260-269			1				1
270-279				1	1		2
280-289						2	2
Total	512	308	112	22	2	2	958
Percent	53.4	32.2	11.7	2.3	0.2	0.2	

Table 16e. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1986 (sexes combined).

Fork length (mm)	Age 3	4	5	6	Total
170-179	8				8
180-189	25				25
190-199	35	5			40
200-209	28	64			92
210-219	6	135	2		143
220-229	1	105	6		112
230-239		46	9	1	56
240-249		6	7	3	16
250-259			2	1	3
260-269				1	1
270-279			2		2
Total	103	361	28	6	498
Percent	20.7	72.5	5.6	1.2	

Table 16f. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1987 (sexes combined).

Fork length (mm)	Age 3	4	5	6	7	Total
170-179	1					1
180-189	18	5				23
190-199	26	29	1			56
200-209	8	147	6			161
210-219	3	216	21			240
220-229	1	111	27			139
230-239		17	70	2		89
240-249		2	31	3	1	37
250-259			8	1	2	11
260-269				2		2
Total	57	527	164	8	3	759
Percent	7.5	69.4	21.6	1.1	0.4	

Table 16g. Length-frequency distribution of blueback herring, by age, Mactaquac Dam, 1988 (sexes combined).

Fork length (mm)	Age 3	4	5	6	Total
170-179	7				7
180-189	72				72
190-199	54	40	2		96
200-209	8	158	25		191
210-219		169	74	4	247
220-229		67	108	2	177
230-239		18	85	15	118
240-249		1	23	15	39
250-259			3	8	11
260-269			1	1	2
Total	141	453	321	45	960
Percent	14.7	47.2	33.4	4.7	

Table 17a. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1982 (species and sexes combined).

Fork length (mm)	Age										Total
	3	4	5	6	7	8	9	10	11	12	
180-189	6										6
190-199	56										56
200-209	64	4									68
210-219	38	20									58
220-229	11	32	5								48
230-239	4	63	15	3							85
240-249	1	71	49	13	3	2					139
250-259		56	69	37	12	7	5	3			189
260-269		30	135	52	15	16	12	5	2	1	268
270-279		7	112	39	8	20	21	5			212
280-289			67	35	15	11	15	8	3		154
290-299			11	25	14	23	8	3	2		86
300-309			2	8	15	19	12			1	57
310-319					4	15	2	1			22
320-329						1		2			3
330-339						1					1
340-349					1						1
Total	180	283	465	212	87	115	75	27	7	2	1453
Percent	12.4	19.5	32.0	14.6	6.0	7.9	5.2	1.9	0.5	0.1	

Table 17b. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1983 (species and sexes combined).

Fork length (mm)	Age												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
90- 99	1												1
100-109	1												1
110-119													0
120-129													0
130-139													0
140-149		1											1
150-159		1											1
160-169													0
170-179			1										1
180-189			9										9
190-199			63	9									72
200-209			71	14									85
210-219			21	43	2								66
220-229			13	69	24	1							107
230-239			9	66	29		1						105
240-249			2	56	54	12	1						125
250-259				47	62	9	7	2	1	1			129
260-269				19	76	26	9	4	4	4			142
270-279				6	99	61	7	8	1	3	1		186
280-289					66	86	17	5	5		1	1	181
290-299					29	54	17	5				2	107
300-309					7	25	9	4	3		1		49
310-319					1	7	4	4	3				19
320-329					1	2							3
330-339								1					1
Total	2	2	189	329	450	283	72	33	17	8	3	3	1391
Percent	0.1	0.1	13.6	23.7	32.4	20.3	5.2	2.4	1.2	0.6	0.2	0.2	

Table 17c. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1984 (species and sexes combined)

Fork length (mm)	Age											Total
	2	3	4	5	6	7	8	9	10	11	12	
150-159	1											1
160-169												0
170-179		1										1
180-189		22										22
190-199		47	1									48
200-209		44	15	1								60
210-219		13	118	6								137
220-229		3	184	19								206
230-239			107	49	8	1						165
240-249			71	42	5	1	1					120
250-259			47	105	12	5						169
260-269			15	113	15	4	2	2	1			152
270-279			2	68	42	9	1					122
280-289				29	56	18	2	2	1			108
290-299				8	24	25	8					65
300-309				2	2	18	9	2	1		1	35
310-319						4	4	1	2			11
320-329										1		1
Total	1	130	560	442	164	85	27	7	5	1	1	1423
Percent	0.1	9.1	39.4	31.1	11.5	6.0	1.9	0.5	0.4	0.1	0.1	

Table 17d. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1985 (species and sexes combined).

Fork length (mm)	Age									Total
	2	3	4	5	6	7	8	9	10	
140-149	1									1
150-159										0
160-169	1	1								2
170-179	1	14								15
180-189		123	1							124
190-199		248	7							255
200-209		98	27							125
210-219		34	80	9	1					124
220-229		13	113	29						155
230-239		7	98	44	5					154
240-249			42	23	10					75
250-259			44	40	9	1				94
260-269			11	87	14	1				113
270-279				103	29	4				136
280-289				43	42	13	4			102
290-299				7	22	18	5			52
300-309				2	10	11	6		1	30
310-319						6	4	3	1	14
320-329						1	2	2		5
330-339							1			1
Total	3	538	423	387	142	55	22	5	2	1577
Percent	0.2	34.1	26.8	24.5	9.0	3.5	1.4	0.3	0.1	

Table 17e. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1986 (species and sexes combined).

Fork length (mm)	Age								Total
	2	3	4	5	6	7	8	9	
150-159	1								1
160-169									0
170-179		8							8
180-189		25							25
190-199		35	5						40
200-209		28	64						92
210-219		7	136	2					145
220-229		2	115	6					123
230-239		1	77	9	1				88
240-249			127	7	3				137
250-259			248	10	1				259
260-269			135	26	2				163
270-279			22	26	15				63
280-289			1	12	8				21
290-299				1	12	2			15
300-309					3		1	1	5
310-319						1			1
Total	1	106	930	99	45	3	1	1	1186
Percent	0.1	8.9	78.4	8.3	3.8	0.3	0.1	0.1	

Table 17f. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1987 (species and sexes combined).

Fork length (mm)	Age 3	4	5	6	7	Total
170-179	1					1
180-189	18	5				23
190-199	26	29	1			56
200-209	8	147	6			161
210-219	5	216	21			242
220-229	2	114	27			143
230-239		58	71	2		131
240-249		105	40	3	1	149
250-259		89	74	2	2	167
260-269		23	174	5	1	203
270-279		2	113	13	1	129
280-289			33	14	3	50
290-299			2	5	1	8
300-309					2	2
310-319				1	1	2
Total	60	788	562	45	12	1467
Percent	4.1	53.7	38.3	3.1	0.8	

Table 17g. Length-frequency distribution of gaspereau, by age, Mactaquac Dam, 1988 (species and sexes combined).

Fork length (mm)	Age 3	4	5	6	7	Total
170-179	7					7
180-189	72					72
190-199	54	40	2			96
200-209	8	158	25			191
210-219	1	170	74	4		249
220-229	1	77	108	2		188
230-239		49	85	15		149
240-249		65	36	16		117
250-259		13	109	14		136
260-269			116	55		171
270-279			38	94	5	137
280-289			2	62	10	74
290-299				11	8	19
300-309				1	1	2
310-319						0
320-329				1		1
Total	143	572	595	275	24	1609
Percent	8.9	35.6	37.0	17.1	1.5	

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REFERENCES

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish and Wildlife Serv., Fish. Bull. 53(74), 577 p.

Cating, J.P. 1953. Determining age of Atlantic shad from their scales. U.S. Fish and Wildlife. Serv. Bull. 54:187-199.

Jessop, B.M. 1977a. Life history data on the alewife and blueback herring of the Saint John River, New Brunswick, 1973. Dept. of Fisheries and the Environment Data Record Series No. MAR/D-77-2, 49 p.

Jessop, B.M. 1977b. Life history data on the alewife and blueback herring of the Saint John River, New Brunswick, 1974. Dept. of Fisheries and the Environment Data Record Series No. MAR/D-77-3, 59 p.

Jessop, B.M., A.H. Vromans and W.E. Anderson. 1982. Life-history data on alewife and blueback herring, Mactaquac Dam, 1975-81. Can. Data Rep. Fish. Aquat. Sci. No. 367, vii + 43p.

MacLean, P., G.E. (Buck) Newsome and P.A. Dill. 1981. Discrimination by external features between alewife (*Alosa pseudoharengus)* and blueback herring (*A. aestivalis)*. Can. J. Fish. Aquat. Sci. 38 (5): 544-546.

Marcy, B.C. 1969. Age determinations from scales of *Alosa pseudoharengus* (Wilson) and *Alosa aestivalis* (Mitchill) in Connecticut waters. Trans. Amer. Fish. Soc. 98(4): 622-630.

Nikolsky, G.V. 1963. The ecology of fishes. Academic Press, London and New York, 352 p.

Power, G. 1964. A technique for preparing scale smears. Trans. Amer. Fish. Soc. 93: 201-202.

Sokal, R.R. and F.J. Rohlf. 1981. Biometry. W.H. Freeman and Company, New York. 859p.